Design Document

RASHOMON

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Table of Contents

Rashomon on 360° Stage with Dynamic Sound

A live-action prototype in which audience members have some agency in determining the manner and the order in which they experience the three main characters' stories in *Rashomon*, through the use of a 360 degree stage setup and rotation-sensor technology. Design Document created by Chautauqua Interactive, Copyright 2009

I. General Information

High Concept

 With this performance we are looking to take an important stride toward answering the question of whether it is possible to provide audience members in traditional theater with a sense of agency through interaction. We are focused on making technology the way through which we provide this interaction.

 We plan to achieve this level of agency through the use of a 360 degree stage setup with dynamic sound capabilities. The stage will surround a group of audience members (5-10 people for the prototype), all seated in swivel chairs rigged up with rotation sensors, that will allow them to willfully direct their attention around the stage and interactively alter their experience with the performance. Thanks to the rotation sensors, we will be able to measure where each audience member is facing in his/her chair, and thus determine which character or section of the stage is receiving his/her attention. We can take this data and use it to affect things like the amplification of the sounds coming from speakers setup around the stage, which will be playing prerecorded dialogue from each of the three characters as well as a layered music composition in which each layer represents each character. Depending on the amount of attention the collective audience is giving a certain character, we will be able to determine whether or not that character's version of the story will be acted out first, second, or third. The audience interacting in this manner supplements the content of the play and should make for an overall richer theatrical experience for everyone involved with the performance.

 In traditional renditions of *Rashomon*, one hears the testimonies and views the stories of the three main characters (Bandit, Wife, and Husband) in a predetermined sequential order. One question we asked ourselves when developing this prototype was if the order in which the stories are told in any way influences an audience member's perception of which character is telling the truth. With this question in mind, we developed our idea for the prototype around the notion of perspective and giving audience members some agency in determining the manner and the order in which they experience the three characters' differing perspectives during a live performance of their stories.

The Tale we Tell

 It is important to remember that we are not telling the full *Rashomon* story in our prototype. Instead we will focus on the events surrounding the Husband's murder and the three main characters involved with the crime. In this sense, our story is more similar to *In a Grove*, the original story which *Rashomon* is based upon.
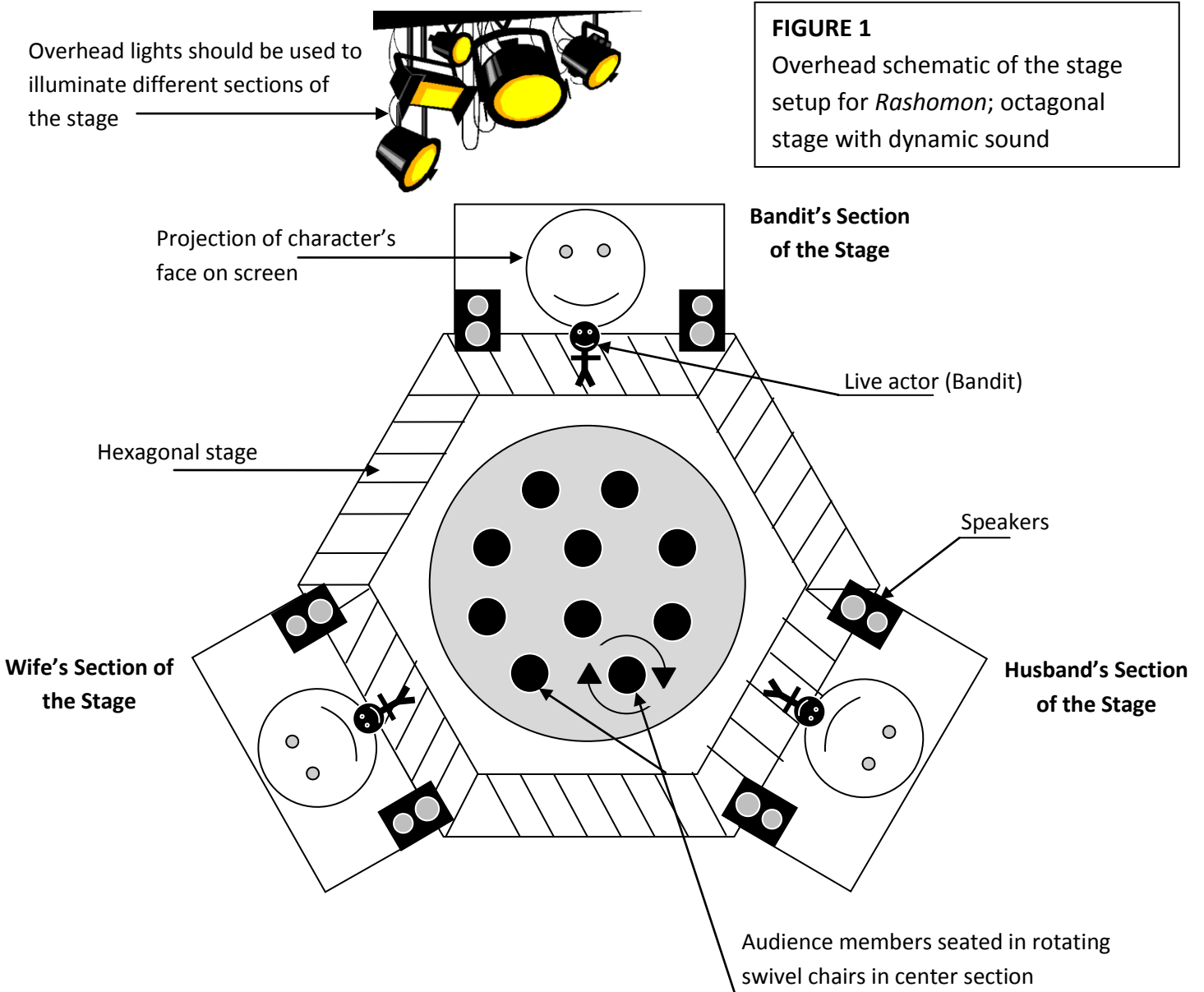
 All three characters tell their own version of how the samurai came to be murdered, and our prototype will focus on these different takes on the story, as well as the events explaining how all three characters came to be together in the forest, most of which they are all in agreement about. The stories

do not diverge until after Tajomaru has "taken" the samurai's wife for himself. *NOTE: For the purpose of this document, the portion of the story leading up to the samurai's death that all three characters agree upon will be referred to as the "Introductory Story."

The Stage Setup

An octagonal stage will be set up around 5-10 audience members seated in swivel chairs. At any time during the performance, audience members can rotate their seats to face any section of the stage. Each seat will be equipped with a rotation sensor, which can detect what direction the audience member is facing. Three projection screens will be set up at opposite ends of the stage, and live actors portraying the Bandit, the Wife, and the Husband will be positioned in front of the screens at the beginning of the performance. Close-ups of the characters' faces will be projected on the screens behind them. The projections of each character will show them in the police court, testifying before the magistrate/jury (crowd) – present time. The live actors will act out the events that have already taken place based on each character's story about what happened in the grove. Each character essentially has his/her own section of the stage, but there will be times when the actors should utilize all of the stage space. See Figure 1 below for an overhead schematic of the stage setup.

Each projection screen will be associated with the sound coming from a speaker underneath it, which facilitates the dynamic sound interaction. All projectors, sensors and speakers need to be directly connected to the PC that controls the performance. The performance will be controlled by an operator on this computer.

Overhead lights should be used to illuminate different sections of the stage

FIGURE 1
Overhead schematic of the stage setup for *Rashomon*; octagonal stage with dynamic sound

Projection of character's face on screen

Bandit's Section of the Stage

Live actor (Bandit)

Hexagonal stage

Speakers

Wife's Section of the Stage

Husband's Section of the Stage

Audience members seated in rotating swivel chairs in center section

Dynamic Sound

     Speakers around the stage will play individual sounds ranging from prerecorded character dialogue to ambient sounds associated with the different characters. The sensors on audience members' chairs will affect the amplification of the sound coming from the speakers depending on which direction they are facing – volume from speakers will increase when the majority of the audience is facing them, and will decrease when audience members are facing away.

II. Detailed Description

One Play Through from Beginning to End

1. The Tutorial

Before the beginning of the play, the title screens will be displayed in the different projection screens. Each screen will show a different image and each speaker will reproduce a different sound. As the audience comes in, they can start experiencing the interaction with this tutorial of sorts. Before the play starts, a master of ceremonies should come on stage and give the audience a quick explanation of the interaction. An alternative to this would be to modify the title screen to include instructions.

2. In the Beginning

The play begins with a prologue video. While this plays, the three actors playing the Bandit, the Wife, and the Husband should position themselves in front of their separate projection screens on their designated sides of the stage. The actors should be facing away from the audience, who are all seated in swivel chairs and may face any direction they like. Instead of the actors speaking at this point, prerecorded dialogue of each character telling the setup story will play from their respective speakers. Prerecorded video of the characters' faces will be projected behind each character and will sync up with the dialogue as the story is told by all three. The separate dialogue tracks will play over each other, but audience members can determine which they hear more prominently by collectively facing a certain character, or dividing their attention as they see fit. If audience members are all facing different characters (this is expected), then sound levels will vary from speaker to speaker depending on where individual audience members are looking. For example, it should be possible to get a high volume from one set of speakers, a medium volume from another set, and a low volume from the other set, if audience members are positioned accordingly.
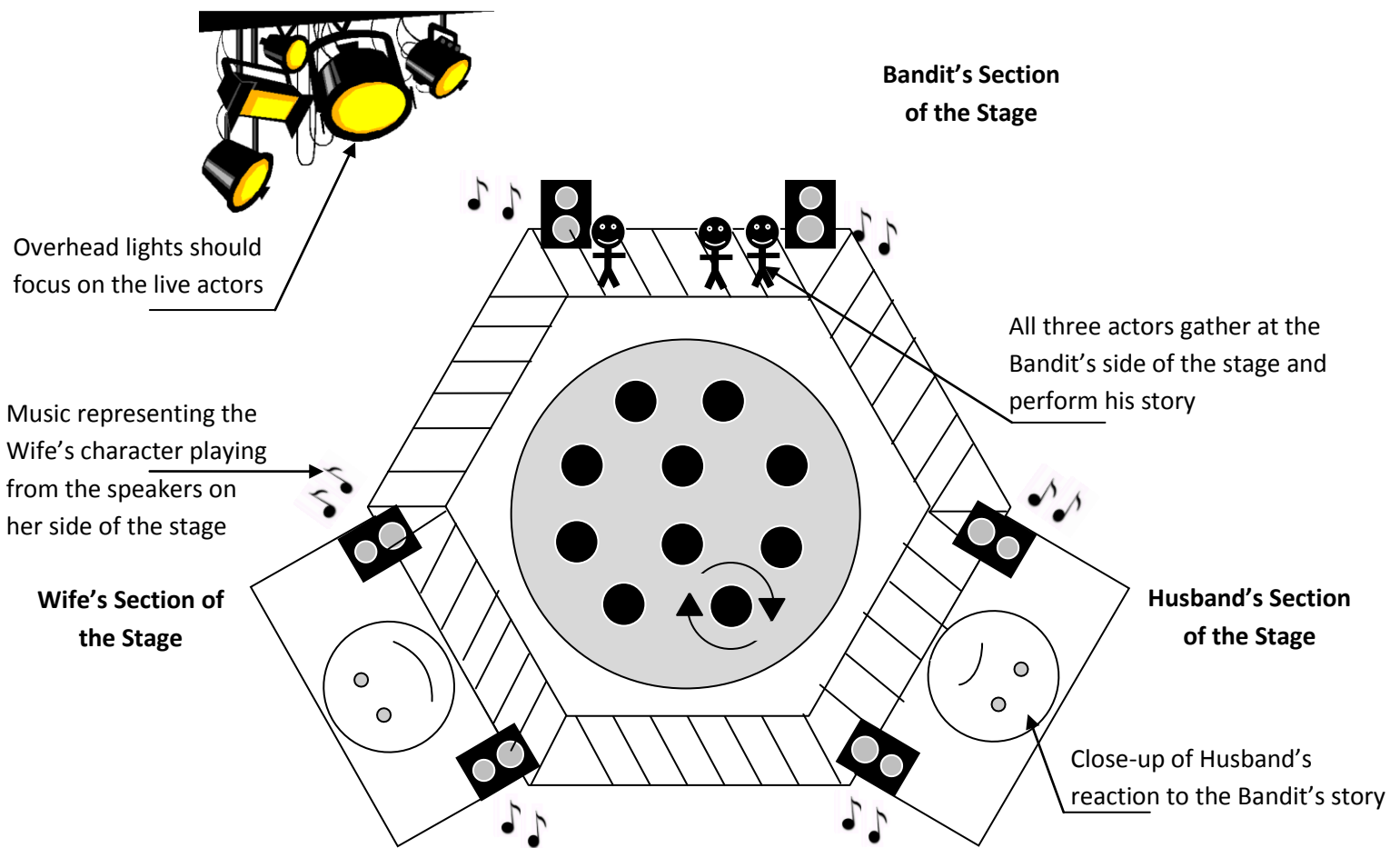
3. The Selection Process

While audience members get familiar with the characters and the setup story, a computer system tied in with the rotation sensors will be keeping track of how much attention they are giving certain characters. When the setup story finishes, the system will determine which character received the most attention from the collective audience and the operator will select that character's story introduction video to play first. The lights on the other characters will go out, and their projections will temporarily fade out since we will need to switch the video feeds. At this time, the live actor playing the character who was selected should pick up his/her story from where he/she left off in the setup story. Each character has one or two lines that will trigger the transition from the POLICE COURT into the FOREST. At this time, the three characters will position themselves according to the stage directions for the story to be told. Prerecorded videos of the non-selected characters' facial reactions to the action on stage should also appear on their respective projectors at this time.

4. Performance and Preferences

Once the three actors on stage begin to act out one character's story, the audience members will have three main focal points to which they can direct their attention: (a) The live action, which should take place mainly at the selected character's section of the stage, but can move around the whole stage at certain times, or (b) the projection of either one of the other characters' prerecorded reactions to the scene being played out. The speakers around the stage will play music that is representative of each character, and this music will be amplified depending on which direction(s) audience members are facing; for example, if the majority of the people in the audience are watching the projection of the Bandit during the Husband's story, then drum-heavy music representing the bandit should play during the scene. The music should be composed so that the three tracks complement each other. This music will serve as feedback for audience members, who are actually determining which of the remaining two characters' stories will play out next by observing their reactions. Figure 2 below shows the setup for a scene in which the Bandit's story is being acted out.

FIGURE 2
Stage Setup for Bandit's Story

**Bandit's Section
of the Stage**

Overhead lights should
focus on the live actors

All three actors gather at the
Bandit's side of the stage and
perform his story

Music representing the
Wife's character playing
from the speakers on
her side of the stage

**Wife's Section of
the Stage**

**Husband's Section
of the Stage**

Close-up of Husband's
reaction to the Bandit's story

5. The Closing Statements

After all the characters have gotten a chance to tell their version of the story, each of them will get a chance to make a closing statement. This statement is done between a character and his projection, and is also done in the order in which the performance took place.

6. The End and Exit Poll

Once all three characters' stories have been acted out in any order, the prototype will end. The entire experience should not last more than 25 minutes. As audience members exit the venue, we will poll them to find out the order in which they experienced the three stories and to see which character they gave the most attention to, and who they believed was telling the truth.

III. Other Aspects of Prototype Design

Characters/Actors

Tajomaru (The Bandit) – "That's Tajomaru all right! Even among bandits, he's famous for his lechery." The infamous bandit, Tajomaru, is crude, crass and cocky. He behaves more like an animal than a human being, but is intelligent in his ability to scheme and think outside of man's laws and established societal structures.

Kinume (The Wife) – "I tried to drown the sight of myself in the river. But even the river scorned me. I can't be that worthless, can I?" Kinume is mysterious. In her story, she claims to love her husband so much that she had to kill him when he looked upon her with disdainful eyes. At the same time, she shamed herself by returning the embrace of Tajomaru's lips.

Takehiko (The Dead Samurai and Husband) – "I'm in the dark now – in the empty, whirling pit of darkness. Curses upon you! Curses upon you who threw me into this black inferno!" Takehiko, calling out from beyond the grave, is angry that his life was taken from him, even though he claims to have killed himself.

World/Tone

The Story of *Rashomon* takes place in Kyoto, Japan, a little over a thousand years ago. More specifically, the action in the full story takes place at the edge of the Rashomon Gate, at a police court, and in a nearby forest. Our prototype will focus mainly on two out of the three settings – the police court and
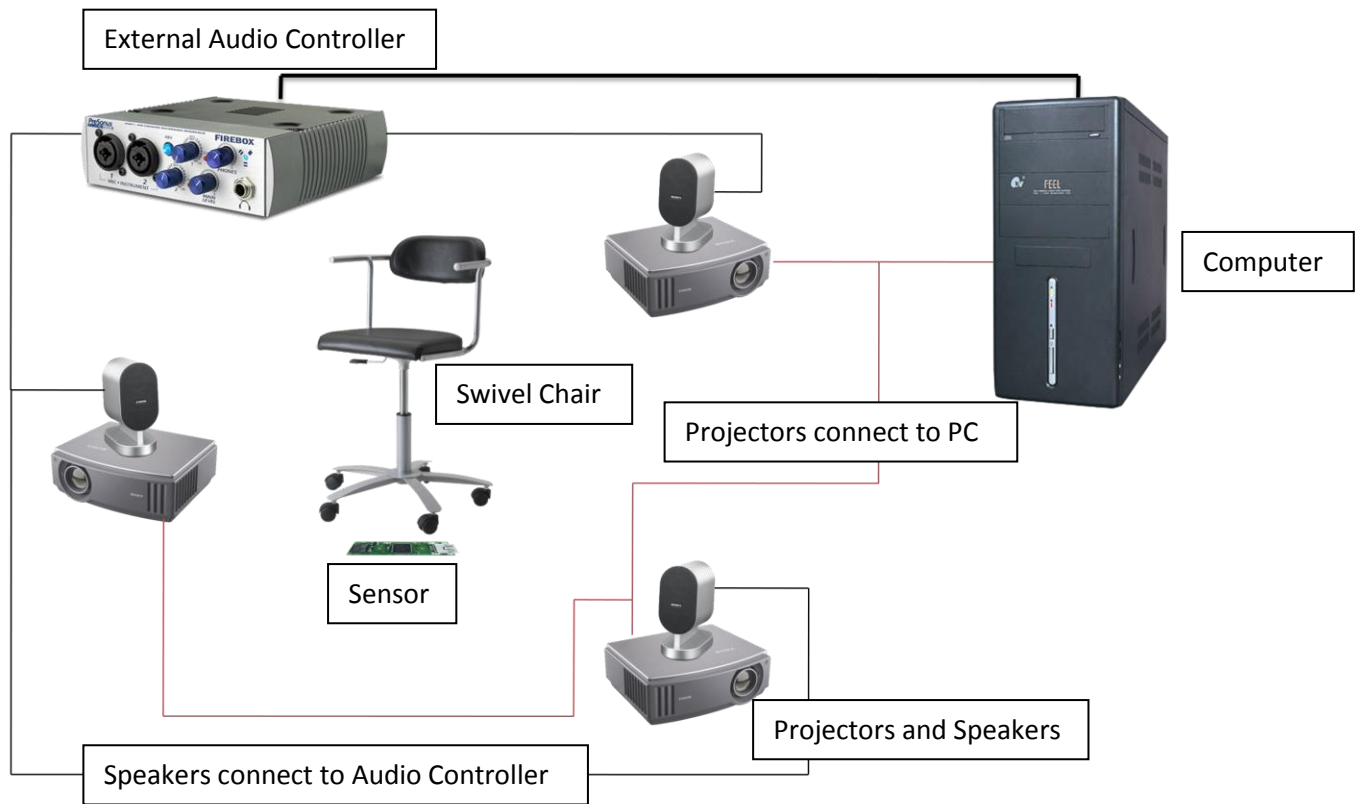
the forest. The tone of the story is a darker one and we should be aware of that when developing the sounds and the projections backdrops for this prototype.

Technology (Sensors & Sound)

We are using Toradex Oak USB Magnetic Rotation Sensors, manufactured in Switzerland. Each of these PCB (Printed Circuit Board) sensors comes with a tiny magnet. When the magnet is placed on a rotating object somewhere above the sensor, the PCB can pick up on the rotation. The sensor can be hooked into a PC via a USB (Universal Serial Bus) cable, so that the data it receives can be sent into a computer. We are using a computer program that will take the data collected by the sensors and use it to affect the amplification of the sound coming from our speakers. Figure 3 below shows the basics of how we expect our technology to work.
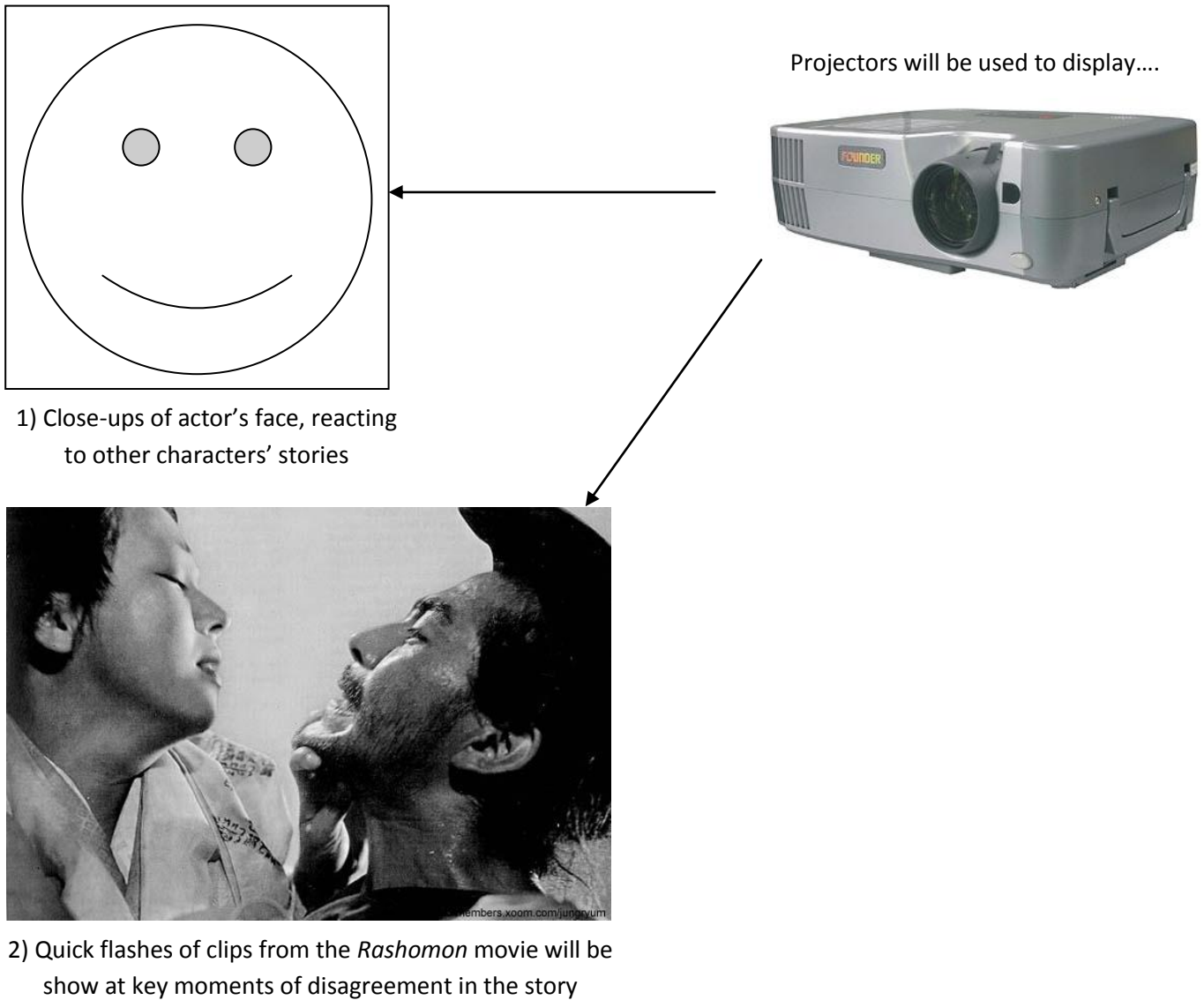
FIGURE 3
Diagram of How Technology for Prototype Should Work

External Audio Controller

Computer

Swivel Chair

Projectors connect to PC

Sensor

Projectors and Speakers

Speakers connect to Audio Controller

Technology (Projections & Prerecorded Video)

Along with our dynamic sound technology, we also plan on having three projectors running that will display prerecorded footage of our actors' faces as well as clips from the *Rashomon* movie and the forest backdrop onto screens on the stage. Figure 4 below visually explains how we will use projections.

FIGURE 4
Projected Images

Projectors will be used to display….

1) Close-ups of actor's face, reacting
   to other characters' stories

2) Quick flashes of clips from the *Rashomon* movie will be
   show at key moments of disagreement in the story

Calibration:

Calibration is designed so that the system is as customizable as possible, both in terms of chair positions and screen allocation. This is to mean, the calibration process should support any number of chairs connected to the system. It is necessary to know, when calibrating, which character will appear on which screen; but what determines these positions is the content, not the technology.

The calibration process basically saves orientation data from each chair for each of the screens, so that the system can have access to the orientation of any chair in relation to the screens during the performance. This means that chairs should never be moved after calibrating. However, chairs can be in any position before calibration.

The calibration process is simple and requires that all the chairs be placed facing the husband screen, then the wife screen and finally the bandit screen. A simple button press is required on the computer for each of these positions.

Sound and Voting Algorithm:

The sound algorithm for the intro videos, as well as the voting algorithm, is based on a dead-zone model. The way this model works is that each chair has a weight on the total volume value of every speaker, though a chair's total contribution (the sum of its three contributions) is not constant.

A particular chair will contribute a volume integer value between 10 and 127 depending on its orientation. The system recollects the sum of the values from all chairs for each speaker and divides it by the number of chairs, thus obtaining a volume integer value between 10 and 127 that is then transmitted to the speakers as MIDI data.

An example of the algorithm implementation can be found below:

Let us assume the chair is facing a point between speaker A and speaker B. If the chair is facing at speaker B, it contributes a value of approximately 127 to that speaker, as well as a value of 17 to speaker A, and a value of 10 to speaker B. As it rotates away from speaker B and closer to speaker A, it will approach a dead-zone where its contribution to both speaker A and speaker B is a value of 17. Finally, as it exits the dead-zone and approaches speaker A, its contribution to that speaker will gradually rise toward 127, while its contribution to speaker B retains a value of 17. The value passed to speaker C is always 10 as long as the chair remains facing the zone between the other two speakers.

The voting algorithm takes the volume data and translates it into data it can use. This is done by checking the volume values every 3 seconds and dividing them by 10. The result is converted to integer and discarded if it is below 6. Then it is accumulated for each speaker, so that a chair directly facing a speaker gives a value of 12, but a chair on a dead-zone, or close to a dead-zone, gives a value of 0. When the voting process ends, the three values are checked and the greater one is considered the winner.

Terminology:

Listed below are some of the main terms we use when we discuss various sections of the performance. I will briefly describe what each term indicates as well as give a little background on the piece of content when applicable. These terms will help make the rest of the document detailing how we created the pre-recorded footage and how a person can use the Max patch to control the performance.

- Participants:
    o The audience members seated in the interaction devices/swivel chairs
    o They represent a panel of judges hearing the testimony of these three individuals
- Audience:
    o The audience members seated outside of the stage/projection screen area
- Projection Screens:
    o Three projection screens are used to present video (to both the participants and audience members) that detail the "present" time in which the characters are given testimony about a murder
- On-Stage Action:
    o Refers to the acting that happens on a circular stage, around and facing towards the participants
    o It represents a particular character's point of view of how the Husband/Samurai was murdered
- Title Screen:
    o This content refers to the three looping images and sounds (Rashomon Gate + rainfall, Masks + piano, Vertically Scrolling picture of the Bandit, Wife, and Husband) that are supposed to be played as participants enter the performance space.
    o This section is intended to give the audience a chance to acquaint themselves with the interaction so that they can focus on the content later on in the piece
        ▪ This did not work nearly as well as planned
        ▪ Most individuals simply spoke with each other during this timeframe
- Prologue:
    o The Prologue refers to the section of video that includes many different short movie clips, placed back-to-back, extracted from Akira Kurosawa's Rashomon (the same content is shown on each projector) and it ends with each character giving a brief introduction to themselves on their own projector screens.
    o This section was intended to help set the tone of the performance and continue the "tutorial" nature of the Title Screen
- Combined Intro:
    o This section refers to the ~5 minute section of video where each character talks at the same time (except in the staggered portion located at the beginning of the section) and details how the characters met in the forest, how the samurai ended up tied to a piece of bamboo, and how the woman was assaulted.

- o This is the only portion of the original short stories, movie, and play that all of the characters agree upon. All of the characters are essentially saying the same content from their individual point of view.
  - o The staggered section at the beginning of the Combined Intro is, once again, an attempt to seamlessly combine a "tutorial" to the interaction with the content of the piece
- Intro Bandit/Wife/Husband Story:
  - o This section refers to the brief introduction that each character makes on the projection screen in regards to their "testimony"/their point of view regarding the events
  - o This section helps the actors get into place/get ready to act out the specific story the participants have chosen through their interaction
- Bandit/Wife/Husband Story:
  - o This section refers to the on-stage acting that takes place after the Intro Bandit/Husband/Wife Story.
  - o It represents a specific character's testimony acted out on the stage
- Bandit/Wife/Husband Emotions:
  - o These videos play during the Bandit/Wife/Husband Story sections and represent the other character's opinions of the character whose story is being told on-stage.
- Bandit/Wife/Husband Extro:
  - o This section refers to the video content that is played after a character's Story section is finished being acted out on stage.
- Finale:
  - o This section refers to the video and acting content that is played after all of the Character's Intro/Story/Extro have been shown/acted out
  - o It represents the character's giving one last statement to the jury before judgement is decided
  - o It also represents a crossover/combination of the video/acting content and seemed to be a nice fusion of technology and theatre which is a microcosm of what we were trying to achieve with the entire experience

Videotaping/Editing "Courtyard" Footage (content shown on projector screens):

In this document I will detail the procedures and equipment we used to film, edit, and compose the pre-recorded footage used in Rashomon.

The decisions that we made in devising this method was influenced by the feedback we received during our various playtests, the many constraints inherent to our project, and the equipment that was available to us. I feel that it is worthwhile to briefly document these issues as they may give a better perspective on how this work can be duplicated or improved in a different situation.

Feedback:

- It is of the UTMOST importance that all of the videos, when played simultaneously during the "Combined Introduction" (not counting the staggered portion that happens at the beginning which functions as a tutorial) start and stop at the same time.
    o Otherwise, the participants, if the character they are paying attention to stops talking and they turn to look at another, that character will usually stop speaking just as they turn which is a major letdown and moment of disappointment.
    o Without tight editing for the Combined Intro, every half a second difference in the character's dialogue/video, introduces negative feedback into the entire experience
- The visual style of the piece should fit the overall theme/story of the performance and be as clear as possible
    o Using different camera angles will help make the video more interesting

Equipment:
- Green Room with lights
- Sony HDV 1080i Handycam Camcorder
- Boom mic
- Projector used as a teleprompter
- Editing Suite
    o Mac Pro
    o HDV capturing tape deck
    o Final Cut Pro
    o Adobe After Effects CS4
    o Compressor

Constraints:
- Selected Actors 6 days before we had a scheduled shoot
    o Actors did not have any time to completely memorize the script
- Only had 3 hours to shoot all footage with actors
    o We did not have time to re-shoot any footage
- We could only shoot with actors one at a time rather than shoot them simultaneously

Strategy:

Given the feedback we received from playtesting, the available equipment, and our constraints, we devised a shooting strategy to achieve the best results.

Script:
    o Although we thought that, optimally, we would like to shoot the entire combined introduction in one take, it was obvious that this would be impossible due to:
        ▪ The Actors didn't have time to memorize the entire script

- Timing the character's dialogue properly would be impossible.
  - o Instead we decided to shoot each chunk of text separately
  - o We also timed the performance of the first actor we worked with, and, using a stop watch, tried to make the other actor's sections of dialogue start and stop at the same time
  - o We tried to shoot each section of dialogue, both in regards to the combined intro and the other footage (Intro, Emotions, Extro, Finale, Prologue) from three different camera angles to:
    - Give us more camera angles to choose from
    - Give us more footage to chose from in terms of temporally aligning the three character's sections of dialogue

Shooting:
  - o The three different camera angles:
    - Medium shot from the chest upwards
    - Close Medium shot from the top of the shoulders upwards
    - Close shot of just the entire face
  - o All of the camera angles are shot from straight-on (characters looking directly into the camera) since we were using a green screen (using different camera angles would have made compositing different background images very difficult)
  - o We hooked a projector to a laptop and had the script shown to the actors on the back wall
  - o We had the actors go through the dialogue a couple times, without recording, to make sure that they said the correct lines AND they said them within the needed amount of time
  - o Then we filmed them shoot each take at least three times successfully from the initial Medium shot angle and then, as time allowed, once or twice from the different angles
  - o We made sure to shoot ALL of the footage from one angle to ensure that we had something to work with. After this, we went back and shot addition footage from other angles
  - o We shot 6 minutes for the Emotion Videos and directed the actors in how they would emote and where they should be looking based on the action we had planned on stage
    - They usually look downwards either to the left, right, or center based on the stage directions and due to the fact that the screens (measurement taken from the bottom of the screen) are raised ~6 feet off of the ground
  - o We made sure the characters were simply well lit to make them as visually comprehensive as possible and ensure that the lightning does not interfere with the keying process
  - o We shot in 1080i HDV to get the best quality possible and then we edited/compressed as we needed in Final Cut/After Effects
  - o We gave the actors some acting direction during the shoot

Editing:
- o I captured the footage into Final Cut Pro using the Apple Intermediate codec which helps make the HDV footage easier to edit and sacrifices a very minimal amount of quality
- o I cut up all of the footage and aligned the multiple takes on top of one-another
- o Despite our efforts using a stop watch and shooting multiple takes to try and get the actor's lines of dialogue to match up during the combined Intro, we still had significant differences between the timing of sections of dialogue
- o We decided which clips to use based on (in the following order of importance)
  - ▪ The quality of the content (how well the actor said their lines)
  - ▪ The timing (how well the timing fit with our goal and the other actor's timing)
  - ▪ Varying camera angles (we tried to mix up the camera angles as much as possible to make the videos different and appealing to the audience)
- o After we made these decisions, if the timing of clips was still off, I cut out and extended the speed of various portions of clips
  - ▪ It's a little tricky, but the effect can be unnoticeable if done correctly
  - ▪ Basically I just sliced little sections of clips (<3 seconds) and decreased the speed at which the clips were played. This, in turn, increased the length of time it took to play these clips.
  - ▪ We always used little sections that did not include any dialogue
- o I added transitions (dissolve to black) to the beginning and end of each clip
- o I exported the video clips separately with the Animation Codec (which is a lossless format) and then brought them into After Effects.
- o I exported the audio tracks separately in an uncompressed format 32-bit and gave them to Aaron to master/balance the sound levels

Compositing:
- o In After Effects I edited every clip in the following manner:
  - ▪ Used the Keylight effect to remove the green screen
  - ▪ Animated the color attribute of Keylight to make sure the dissolves looked good
  - ▪ Turned the clip Black and White by desaturating it 100%
- o I finally exported the clip from After Effects using the Animation Codec

Final Compression/Export:
- o I used Compressor to compress and crop each file (to make sure that it was 4:3 rather than its native 16x9 since our projector and projector screen both have 4:3 screen dimensions)
  - ▪ I compressed the files into:
    - • .mov
    - • PhotoJPEG Codec – Quality at 85%
    - • 4:3 crop

      o   This gave us a small enough file at a decent file size that could be run in Max/MSP/Jitter

Max/MSP/Jitter:

We used Max/MSP/Jitter to act as a bridge between the C++ apps that gather the rotation data from the sensors, convert them to MIDI, and incorporate the dynamically changing audio in the performance. It is also the primary controller of the video/audio segments that make up the entire performance.

Max/MSP/Jitter (ie. MAX 5) is a powerful audio/visual software that is used in many interactive/artistic performances and installations. The work we have done in Max can "easily" be expanded to work with the data we get from the sensors and modify various other attributes of this performance such as lights, video effects, etc. I will try to detail the major features of our Max patch to give some basic insight into how it operates. I will also detail, specifically, how the patch is used during any given performance.

Max Script:
Although we used *RashomonSoundPrototype_v85_PolyWorld.maxpat* in each performance, I will be using *RashomonSoundPrototype_v85_PolyWorld-Clean.maxpat* as a visual aid as it is the exact same patch but just cleaned up and it looks nicer. Although it SHOULD operate identically to the non-clean version, we have NOT tested it.

Main Patch:
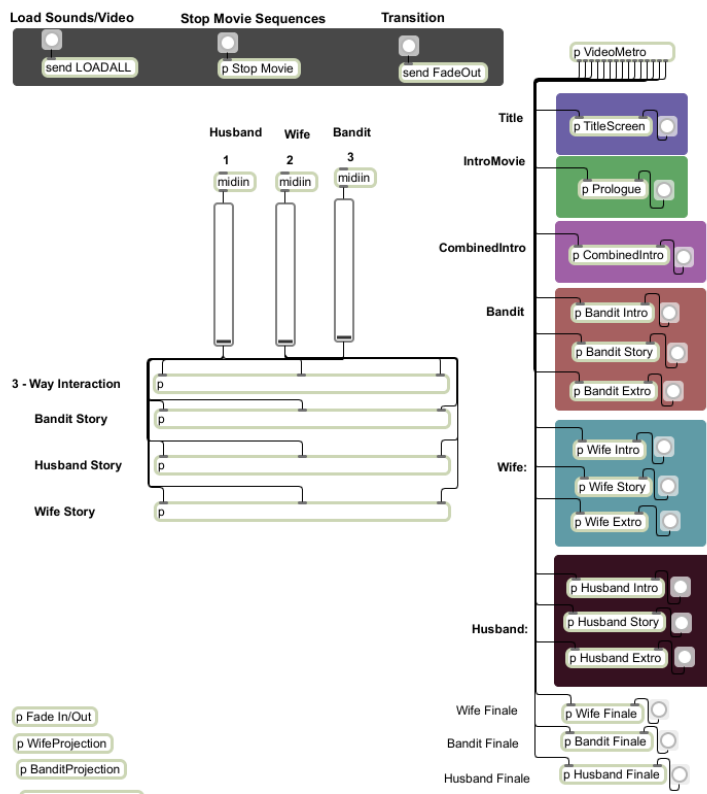
This is the main patch that is used for the Rashomon performance. I have utilized a

wide variety of encapsulation and instancing techniques to make it as usable/readable and efficient as possible. Users who do not want to edit the patch only need to operate in presentation mode (the lock at the bottom of the Max screen is closed) and do not need to look into any of the various code segments.

Users can view the contents of any encapsulated patch simply by double clicking on any of the objects that start with 'p' and have a space between them and a name (or no name at all in the case of the music sub-patches).

Creation History:

I developed this patch overtime as I learned Max and continued to add improvements. Feel free to browse the Max patch revision history I have posted on Randon to see the progression.

Optimization techniques/effects:

I integrated a variety of optimization techniques into the Patch so that we could run three full screen videos and audio streams while receiving a large amount of midi data simultaneously. The program would not run efficiently without them.
- Colormode uyvy:
  - creates a quicktime movie with half of the color data. Since we used B&W videos the difference in quality is non-existent. However it will not fade correctly, so I was only able to use it when fades weren't needed.
- Movie resolution:
  - the movie resolutions can be tweaked to help save memory and make the files run more efficiently
- Instancing:
  - I instanced the movies so that instead of running 30+ jit.qt.movies we only ran four instanced versions. This was hugely helpful at the end of the semester.
- Fade:
  - I added a fade effect that allowed videos and audio to be faded nicely and not cause abrupt start/stops to any type of content
- Consolidated Metro:
  - I only used one Metro (by utilizing gates) to run every piece of content which greatly helped reduce the CPU needed to run the program
- Pre-Load content:
  - I allow the user to load all of the content into memory before the performance starts so that movies/audio files can be played/stopped as seamlessly as possible
- Position the movies:
  - I positioned the movies and set their size to as small as possible to increase efficiently and utilize a 3 monitor/projector setup.

Resources:
- Max/Jitter Tutorials
  o Absolute an essential resource to anyone trying to learn Max. It gave me the headstart I needed and was a constant reference to me throughout the semester.
- Max/Jitter Help Files:
  o These are interactive help files that demonstrate the uses of objects. Referenced constantly.
- Max/Jitter Reference Files:
  o These reference files list out all of the attributes/input messages/details for each object in Max. Constantly referenced.
- Cycling Forums – Jitter:
  o The forum was insanely helpful for figuring out some of the more complicated techniques I was trying to pull off. Everyone is really nice and helpful. I don't know if this project would have been completed as well as it was without them.
  o http://www.cycling74.com/forums/index.php?t=thread&frm_id=8&rid=0&S=425b0180 1c41fef84d77deadd4e27684
  o Search for my name "Ben Miller" and you should find all of the posts I made throughout the semester.